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ABSTRACT

A study of infant language acquisition investigated the possibility that perceptual or attentional tendencies may guide early word learning by directing infants' attention in linguistically relevant ways. In the experiment, infants aged 9 to 13 months watched a puppet show; with some children, sentences labeling either the objects (noun-frame condition) or the actions (verb-frame condition) were presented, and with others, they were not (unlabeled condition). The amount of time the infants looked at the action or looked away was measured. It was predicted that infants who were given verbs or nouns to apply to the action and objects would focus more attention on them than those for whom no labels were given. Noun-frame condition subjects paid more attention than unlabeled condition subjects. Verb-frame condition subjects paid less attention than those in the noun-frame condition but more than those in the unlabeled condition, suggesting that the noun-frame is more effective than the verb-frame, which is in turn more effective than non-labeling in directing attention to the object. These data were compared with previous, similar research. Results suggest that infants as young as 13 months are sensitive to prosodic cues to the structure of their language. (MSE)

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THE ROLE OF LINGUISTIC CONTEXT IN THE IDENTIFICATION OF NOUNS AND VERBS BY YOUNG LANGUAGE LEARNERS

Paper presented at the Boston University Conference on Language Development,
October, 1992, Boston, MA

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THE ROLE OF LINGUISTIC CONTEXT IN THE IDENTIFICATION OF NOUNS AND VERBS BY YOUNG LANGUAGE LEARNERS

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I'll talk today about some research suggesting that infants as young as 13 months are showing limited sensitivity to linguistic cues to word meaning. These results contribute to an expanding body of literature investigating the degree to which syntactic structure directs word learning. Much of the recent research in this area is coming out of various "bootstrapping" views of language acquistion (e.g., Gleitman, 1990; Grimshaw, 1981; Pinker, 1984). Although there is some disagreement about the exact nature of the bootstrapping process, the different perspectives represent variants on the idea that children use one source of evidence about the structure of word meanings or of grammar to discover other forms of structure and, in doing so, build up to competence in their native language. I've actually come to this problem from a slightly different perspective, although I think that the results may have some implications for those accounts.

This particular research was motivated at least in part by a desire to explain developmental differences observed in some of my previous research. That research concerned the possibility that perceptual or attentional tendencies may guide early word learning by directing infants' attention in linguistically-relevant ways. In particular, I was interested in the possibility that infants may focus more selectively on objects when they are labeled (e.g., Baldwin & Markman, 1989) and that such a tendency may serve as a precursor to Markman's *whole object assumption* (e.g., Markman, 1990) and thereby assist with the initial identifications of word meanings. Because that research provides the motivation for the present study, I would like to summarize it.

The previous research, like the present study, used a familiarization procedure in which 9- and 14-month old infants saw events involving moving objects. Half of the infants heard the events labeled and half heard no labeling. The question of interest was whether infants would attend differently when events were labeled as opposed to unlabeled and, if they attended differently, what their attention would be drawn toward. In particular, the prediction that labeling would direct attention to objects was contrasted with the prediction that infants would become focused on an element that was consistent across labeled events. Accordingly, infants were presented with events in which either the object was consistent and the motion varied or in which the motion was consistent and the object varied. After familiarization to these events, they saw test trials consisting of (a) a *novel object* undergoing a familiar motion and (b) a familiar object undergoing a *novel motion*. (The design is presented schematically in Figure 1). If labeling draws attention to objects, infants in both the consistent object and the consistent motion condition should be more focused on the objects during familiarization and, as a result, should be more attentive to the change in object during the test trials, than should infants who hear no labeling. On the other hand, if labeling draws attention to consistency, then infants in the consistent motion condition who hear labeling should focus on the motion during familiarization, because the motion is the element that is consistent, and should thus be more attentive to the change in motion during the test trials.

The results of that study suggested a change between 9- and 14-months in attention to labeled events. These results are shown in Figure 2, presented in the form of proportion looking to the novel object (that is, the amount of time spent looking during the novel object test trials divided by the total amount of time spent looking at both types of test trials). As can be seen in Figure 2, 9-month old infants who heard no labeling showed a slight preference for the novel object. For

those in the consistent object condition, labeling had no effect (that is, those infants still showed a slight preference for the novel object). However, 9-month olds in the consistent motion condition showed a significant decrease in proportion looking to the novel object, indicating an increase in proportion looking to the novel motion. Although there are other possible explanations for these results, they are consistent with the suggestion that labeling directs attention to consistency for 9-month old infants. In contrast, 14-month old infants showed an increase in attention to objects with labeling regardless of whether the object had been consistent. Thus, the pattern of results with the older infants is consistent with the view that labeling directs attention to objects regardless of consistency.

There are at least two possible explanations for the differences in patterns of attention, in the presence of labeling, between 9 and 14 months. One possibility is that there is a change between 9 and 14 months in the effects of labeling on attention such that the older infants are strongly directed toward objects in the presence of labeling. Fourteen months is shortly before the age at which infants typically exhibit a rapid increase in productive vocabulary, particularly nouns (Nelson, 1973), and it may be that they are becoming particularly focused on objects in the presence of labeling. A second possibility, however, is that the older infants may be starting to notice the linguistic context in which a word is presented and, in particular, to notice the frame provided by the surrounding words. In the experiments with 9- and 14-month old infants, the nonsense word labels were always embedded noun-like frames (e.g., "that's a *danu*"; "it's a *danu*"). It could be that by 14 months of age, infants are starting to expect such frames to be associated with object words.

In the present study, linguistic context was varied to determine whether the effect of labeling on older infants' attention to objects could be due to a developing sensitivity to the context in which a novel word is presented. The experimental set-up is presented in Figure 3. Infants are seated on a parent's lap, facing a puppet stage. One researcher is concealed behind the puppet stage to manipulate the experimental stimuli. A speaker for the presentation of the labeling sentences is concealed beneath the table which supports the puppet stage. A second researcher is concealed behind a one-way mirror to time the infant's looking behavior. That second researcher records the infants' looking behavior, using a timing program on a computer, by pressing a button when the infant looks and releasing the button when the infant looks away. The program emits a beep when criteria for ending the trial are met, that is, when either (a) the infant has looked away for 1.25 seconds or (b) the infant has looked for a cumulative total of 30 seconds. The session is also videotaped so that the on-line timing of the infant's looking behavior can be verified. Parents were asked to close their eyes during the test trials so that they could not inadvertently influence their infants' responses.

Infants were assigned to a *noun-frame*, to a *verb-frame* or to an *unlabeled* condition.[1] All infants were familiarized with sequences consisting of objects undergoing particular motions. For infants in the noun-frame condition, the sequences were labeled with noun frames containing a nonsense word label (e.g., *that's a gep*). For infants in the verb-frame condition, the labels were phrases like *that's geping*. The test trials for all infants were (a) a familiar object paired with a novel motion and (b) a familiar motion paired with a novel object.

If infants are sensitive to the frame, then they should attend differently in the verb-frame than in the noun-frame condition. In particular, at least three different outcomes might be expected. Hypothesis 1 is that labeling per se results in an increase in attention to objects, that is, there is something general about labeling, rather than anything about specific words, which enhances

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[1] The use of the terms *noun-frame* and *verb-frame* are intended to be purely descriptive; the use of these terms is not intended to imply that infants are actually perceive the words included in the frames as nouns or verbs. If infants are sensitive to, for example, the noun frames, this sensitivity could be rather limited in scope, that is, it could reflect nothing more than a recognition that, for example, "that's a" is typically followed by an object word.

attention to objects. This hypothesis predicts that infants in either of the two labeling conditions should show a higher proportion looking to the novel object than should infants in the unlabeled condition. Hypothesis 2 is that the older infants in the previous study were, in fact, attending to the linguistic frame and were more attentive to the objects in the labeled condition because the frame directed them towards the objects. In that view, infants should show an increase in attention to the novel object only in the noun-label condition; the looking behavior of infants in the verb-label condition should be similar to that of infants in the unlabeled condition. Finally, there is what might be described as Hypothesis 2a: It may be that these older infants would be sensitive not only to the noun-frame, but also to the verb-frame. In such an event, it should not only be that infants in the noun-frame condition will be more focused on objects than infants in the unlabeled condition, but infants in the verb-label condition should be more focused on the motion. Thus, whereas infants in the noun-label condition should show an increase in proportion looking to the novel object relative to infants hearing no labeling, infants in the verb-label condition should show a decrease in proportion looking to the novel object. These hypotheses are presented schematically in Figure 4. Due to subject pool considerations, subjects for this study were 13 months old rather than 14 months as in the previous study.

Results are presented in Figure 5 and they are presented as a bar graph in Figure 6. As before, results are presented in terms of proportion looking to the novel object. I will first consider the noun-frame condition and the unlabeled condition, which are essentially comparable to the unlabeled and labeled conditions in the previous study. The first thing to notice is that the results actually look more comparable to the previous results with the 9-month olds than those with the 14-month olds: Infants in the consistent object condition who heard the noun frame showed an increase in attention to the object with labeling whereas those in the consistent motion condition showed a decrease in proportion looking to the novel object. These results may suggest that, as for the 9-month olds in the previous study, the noun-frame is directing the attention of these 13-month old infants to an element that is consistent across labeled events, or at least that an object needs to be consistent for labeling to direct attention to it. These differences between the previous results with 14-month olds and the current results with 13-month old infants could be due to one of several reasons: (a) the slight differences in age; (b) differences in subject pools between Palo Alto, CA and Austin, TX; (c) some slight changes in procedure.

Turning to the verb-frame condition, infants in the consistent object condition showed a decrease in proportion looking to the novel object relative to infants in the noun-frame condition, but an increase relative to infants in the unlabeled condition. These results may suggest that the noun-frame is more effective than the verb-frame in directing attention to the object but that the verb-frame is also doing some enhancing of attention to the object. Infants in the consistent motion condition showed a pattern similar to that shown by infants hearing the noun-frame. Thus, the verb-frame did not appear to be effective in directing infants' attention to motions. These observations are supported by a significant labeling X condition interaction, with $F(2,17) = 5.34$, $p < .02$. Post-hoc tests reveal that, among infants in the consistent object condition, those who heard the noun-labeling showed a significantly higher proportion looking to the novel object than those who heard no labeling (Tukey's, $p = .05$). Infants who heard the verb label did not differ significantly either from infants who heard the noun label or from infants who heard no labeling.

So what do these results mean? One possible interpretation is that 13-month old infants are in a transition phase such that they are still showing a tendency to attend to consistency in the presence of labeling (or at least to focus on an object only when it is consistent), but are beginning to show a sensitivity to linguistic context, and in particular, to a noun-frame.

A second possible interpretation is that infants are primarily influenced by the linguistic frame, but some infants in the verb-labeled condition have interpreted the verb-frame as something other than a verb-frame. In particular, these infants may have interpreted verb-frames like *that's*

gepping as a noun-frame in which *gepping* is a proper noun. I am currently beginning research which is designed to sort out these possibilities.

Turning now to possible implications for "bootstrapping" into the syntax of the native language language, I will take the liberty of being very speculative: Labeling may initially direct attention in a very general way toward linguistically-relevant elements of an event and, in particular, toward an object that is consistent across labeled events. By about 13 months, infants may be starting to notice certain frames that tend to be associated with object words. This sensitivity could simply be lexically driven, that is, infants may simply have noticed that, for example, *thatsa* tends to precede object words. Alternatively, infants may be starting to pick up on something about the structure of language. These two possibilities cannot be distinguished at this point.

However, even if these sensitvities are initially lexically-driven, it is clear from other research that infants younger than 13 months are sensitive to prosodic cues to the structure of their language (e.g., Hirsh-Pasek, Kemler Nelson, Jusczyk, Wright-Cassidy, Druss & Kennedy, 1987; Jusczyk, Cutler & Redanz, in press; Jusczyk, Hirsh-Pasek, Kemler Nelson, Kennedy, Woodward & Piwoz, 1992) and, around this age, are beginning to show sensitivity to relationships between words within a sentence (e.g., Golinkoff, Diznoff, Yasik & Hirsh-Pasek, 1992; Golinkoff, Mennuti, Lengle & Hermon, 1992; Hirsh-Pasek & Golinkoff, in press; Naigles, 1990). It may be that sensitivity to these frames will provide a converging source of evidence which, along with this other evidence, will enable children to determine the relationships between grammatical structure and meaning in their language.

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Figure 1.

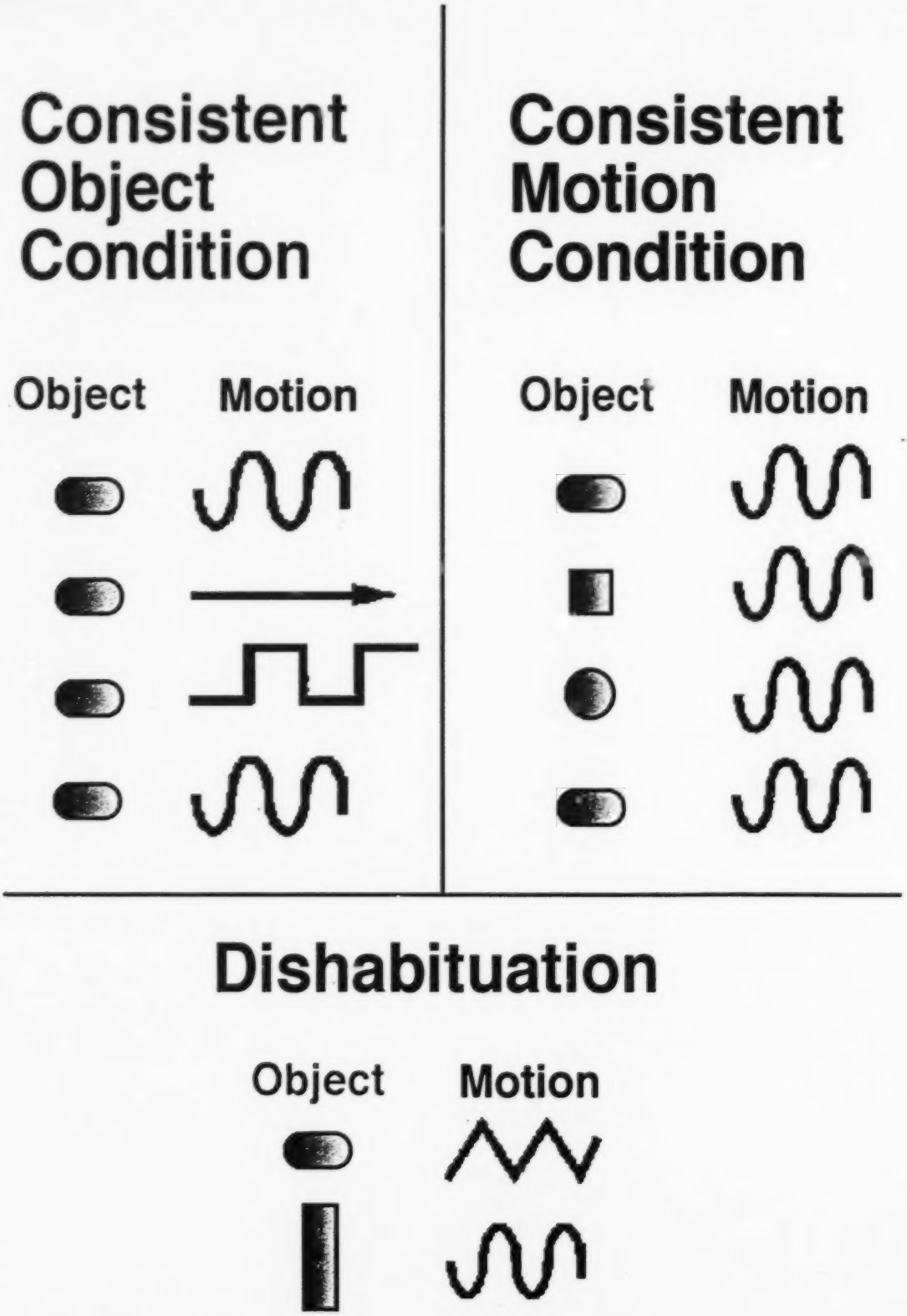
Consistent Object Condition
Object
Motion
Consistent Motion Condition
Object
Motion
Dishabituation
Object
Motion

Figure 2. Previous Results: Attention to object versus consistency in labeled and unlabeled conditions

Proportion Looking to the Novel Object: 9-month old Infants

	Consistent Motion	Consistent Object
Unlabeled	.56	.62
Labeled	.45	.64

Proportion Looking to the Novel Object: 14-month old Infants

	Consistent Motion	Consistent Object
Unlabeled	.50	.52
Labeled	.59	.62

Figure 3.

Experimental Setup

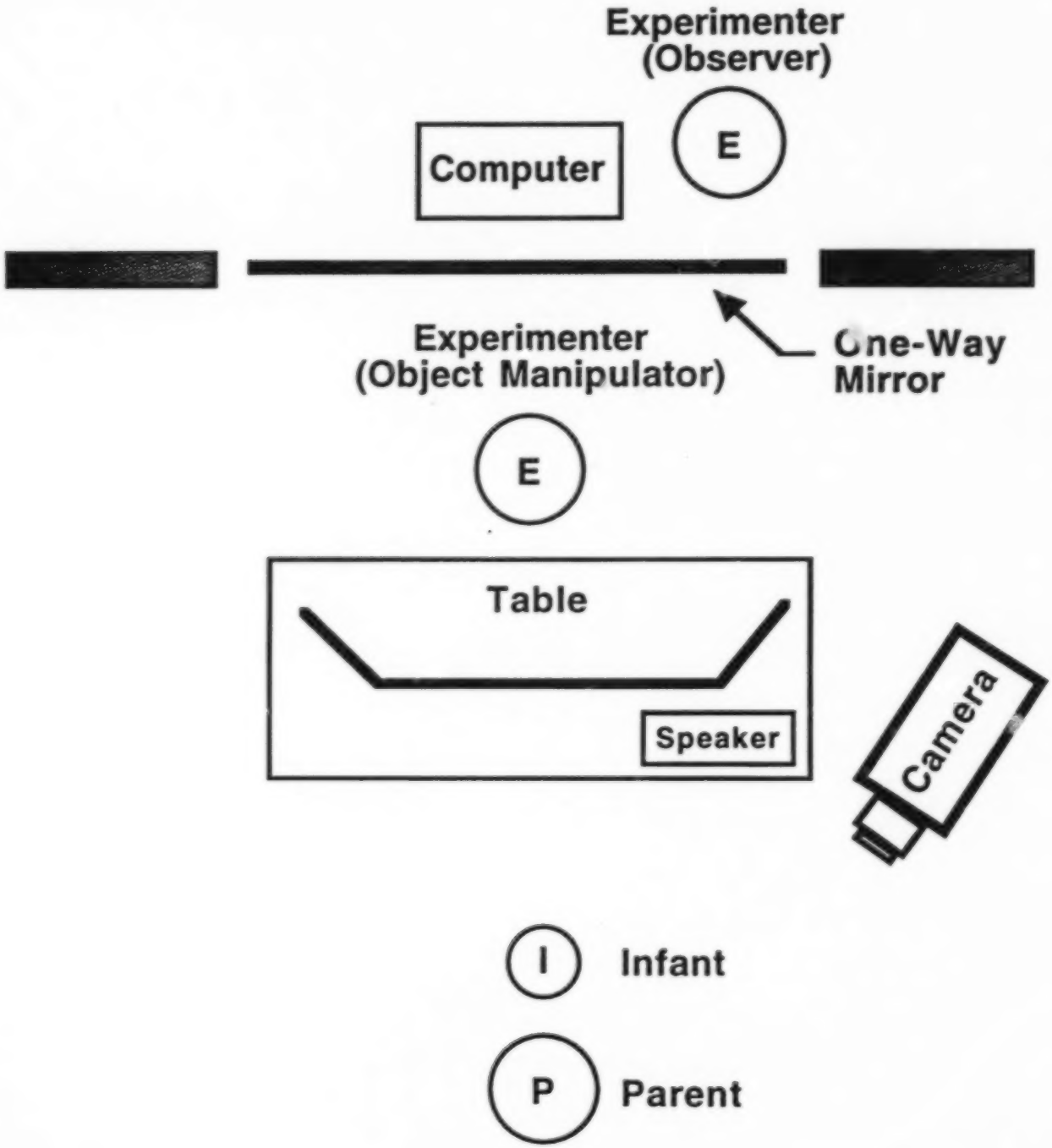

Figure 4. Expected Results: Proportion novel object relative to unlabeled condition

Hypothesis 1
Attention to object with labeling

	Noun-frame	Verb-frame
Consistent Object	↑	↑
Consistent Motion	↑	↑

Hypothesis 2
Attention to noun-frame

	Noun-frame	Verb-frame
Consistent Object	↑	=
Consistent Motion	↑	=

Hypothesis 2a
Attention to noun- and verb-frame

	Noun-frame	Verb-frame
Consistent Object	↑	↓
Consistent Motion	↑	↓

Figure 5. Proportion Looking to Novel Object as a Function of Labeling and Condition

	Consistent Motion	Consistent Object
Unlabeled	.56	.43
Noun-Labeled	.48	.70
Verb-Labeled	.49	.57

Figure 6 Proportion Looking to the Novel Object - Noun and Verb Labels